Study of Radiological findings in High resolution computed tomography (HRCT) temporal bone in Chronic suppurative otitis Media (CSOM): A hospital Based cross sectional study.

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INTRODUCTION
Chronic suppurative otitis media and resultant hearing loss remains a significant health problem in terms of prevalence, economics and sequelae. Short and long-term sequelae of otitis media may be devastating. It can be avoided if recognized early and properly treated. Early surgical intervention is needed to limit the disease. The presence, location and extent of disease along with the presence of any complications determine the surgical approach to be followed. As such imaging plays an important role in providing crucial information to the surgeon in this regard. Many imaging modalities are available for the evaluation of the temporal bone, including plain radiographs, angiography, cerebrospinal fluid (CSF) analysis, air and non-ionic contrast cisternography, computed tomography (CT) with 2D and 3D reconstructions, and magnetic resonance imaging (MRI). CT and MRI are currently the most widely used techniques and have largely replaced other modalities. Conventional radiography has been of value in screening the entire temporal bone. It produces a composite single plane image of a tridimensional temporal bone resulting in superimposition where larger and denser structures obscure smaller and less dense ones. CT scanning excels in the evaluation of bone and air space anatomy and disorders. Because CT scans are more accurate in identifying many soft tissue abnormalities and are much less prone to artifacts, they have largely replaced polytomography; there is also less radiation

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ABSTRACT
BACKGROUND AND OBJECTIVES: To study the HRCT temporal bone findings in chronic middle ear infections with reference to its extent and complications. MATERIALS AND METHODS: After an initial clinical assessment, 30 patients diagnosed clinically with chronic suppurative otitis media (CSOM) were referred for a HRCT of temporal bone which was done with a Siemens’ 16 slice MDCT scanner. RESULTS: Of the 30 patients, 60% were males and 40% were females. Otorrhoea (100%) is the most common symptom. Scutum was eroded in 23 cases. Malleus (18 cases) is the most commonly eroded among the ossicles. Mastoiditis and mastoid abscess (22%) was the most common complication of CSOM followed by Malleus head erosion (60%). Intracranial complications like abscess, Dural sinus thrombosis (4%), Facial canal Dehiscence (4%), Tegmen tympani Erosion (2%). Cochlea erosion, Tegmen mastoideum Erosion, Lateral semicircular canal erosion were not observed in any of the cases. Cholesteatoma were observed in 30 cases out of which 22 (73%) cases exhibited spread in attic, Attico-antral, Mesotympanum and sinus tympanum. Various HRCT findings of temporal bone in chronic suppurative otitis media with cholesteatoma were Non-dependent soft tissue mass in all 30 cases. Scutum erosion in 23 cases, Ossicles erosion in 18 cases, and sigmoid sinus plate erosion in 1 case were observed. Mastoid cortex erosion was seen in 1 case, Sinus erosion in 1 case and Mastoiditis with sub-periosteal abscess in 1 case were also seen. CONCLUSIONS: HRCT of temporal bone is useful in identifying various findings related to the location and extent of disease which are clinically occult and is of great importance in guiding the surgeon in planning the surgical approach.

Key words: Chronic suppurative otitis media, High resolution Computed tomography, cholesteatoma,
to the lens with CT scans than with polytomography. CT has the advantage of producing images with higher contrast and a better spatial resolution. HRCT, a modification of routine CT provides a direct visual window into the temporal bone providing hitherto unavailable minute structural details. The purpose of the study is primarily to understand the capability of CT in diagnosis and detection of various pathological changes occurring in the temporal bone in a case of chronic suppurative otitis media.

MATERIAL AND METHODS:
This is a hospital based cross-sectional study to evaluate the role of HRCT of temporal bone in 30 patients clinically diagnosed with CSOM and referred to the Department of Radio diagnosis and Imaging, GMERS Medical college and Civil Hospital Gotri Vadodara for HRCT scan of temporal bone between April 2016 to August 2016.

Participants: All male and female patients between 1yr and 40 yrs referred with clinical diagnosis of CSOM were imaged. Patients who were clinically diagnosed with chronic suppurative otitis media were subjected for HRCT examination. The visualization of small bone structures, location and extent of lesions and the radiological changes were evaluated. Patients with electric devices at the skull base, such as cochlear implants, those who have undergone previous temporal bone surgeries and those with history of trauma to the temporal bone were excluded from the study. All the HRCT scans were performed at our institute on the Siemens’ 16 slice MDCT scanner. After written informed consent patients were scanned in the axial plane. Permission from IHEC was sought to conduct the study and investigations were done according to world medical declaration of Helsinki.

HRCT Technique in Brief: Topograms were taken routinely in all patients before starting the scan. Scanning commenced from the lower margin of the external auditory meatus including the inferior mastoid and extended upward to the arcuate eminence of the superior semicircular canal as seen on lateral topogram. Slight extension of the head was given to avoid gantry tilt and thereby protect the lens from radiation. Helical acquisition in the axial plane was performed. Reformatted coronal images were obtained perpendicular to the axial plane from the cochlea to the posterior semicircular canal.

Scanning parameters: 140 kV, 200 mA s, 0.625 mm section thickness, 0.625 mm interval, 10-mm beam collimation, 0.562:1 pitch. The contra lateral temporal bone was included for comparison. The images were reconstructed with a bone algorithm. All images were interpreted on Siemens’ syngovia workstation using source images, multiplanar reformations and required window settings. Intravenous contrast was administered to study the intracranial extension of middle ear disease in case of dural sinus erosion only.

RESULTS
Of the 30 patients, the age at presentation ranged from 1yr to 40 yrs. The mean age was 30 years and the maximum numbers of patients affected belonged to the age group of 31 to 40 years. In this study CSOM was slightly more common in males (60%) than females (40%). Otorrhea (100%) is the most common symptom followed by hearing loss (62%), otalgia (30%), vertigo (12%), tinnitus (10%), fever with chills and rigors (10%), headache (8%), nausea and vomiting (8%), swelling behind the ear (4%) and facial weakness (4%). The disease was more common on right side (52%) compared to left side (30%) followed by bilateral disease (18%). Scutum was eroded in 23 cases. Malleus head (18 cases) is the most commonly eroded among the ossicles followed by incus (16 cases) and Malleus handle (10 cases). Wide spectrum of complications of CSOM was observed in the study population. Mastoiditis and mastoid abscess (22%) was the most common complication of CSOM followed by Malleus head erosion (60%). Intracranial complications like abscess, dural sinus thrombosis (4%), Facial canal Dehiscence (4%), Tegmen tympani Erosion (2%), Cochlea erosion, Tegmen mastoideum Erosion, Lateral...
HRCT temporal bone in CSOM

Semicircular canal erosion were not observed in any of the cases. Cholesteatoma were observed in 30 cases out of which 22 (73%) cases exhibited spread in attic, Attico-antral, Mesotympanum and sinus tympanum. Various HRCT findings of temporal bone in chronic suppurative otitis media with cholesteatoma were Non-dependent soft tissue mass in all 30 cases. Scutum erosion in 23 cases, Ossicles erosion in 18 cases, and sigmoid sinus plate erosion in 1 case were observed. Mastoid cortex erosion was seen in 1 case, Sinus erosion in 1 case and Mastoiditis with sub-periosteal abscess in 1 case were also seen.

Figure 1: Dural plate erosion in a case of left sided extensive cholesteatoma.

Figure 2: Facial recess dehiscences on the right side in a case of extensive attico-antral cholesteatoma.

DISCUSSION

In this study, male: female ratio was 1.5:1 which is in accordance with the study by Kemppainen et al. However, in study by Petros V. Vlastarakos et al there was a slightly higher incidence in females. The most common presenting symptom was Otorrhoea followed by hearing loss and otalgia which is in accordance with a study by E. Yorgancilar et al. The incidence of patients presenting with tinnitus, vertigo, nausea, vomiting, fever with chills and rigors and facial nerve palsy were in significant numbers in present series. This probably indicates that the patients come to hospital relatively late and are reluctant for initial treatment. In the present study, right ear was affected more commonly. Bone erosion was identified in in 70% cases. This value is in accordance with data by Firas Q. Alzoubi et al and O’Reilly et al. This finding is however not correlating with Jackler et al. Scutum erosion was seen in 80% cases with cholesteatoma which is in accordance with that seen by Gaurano JL et al. Ossicular erosion was observed in most cases of CSOM associated with cholesteatoma. Though there was some variation in the incidence of erosion of each ossicle in different studies, it was identified that incus is the most commonly involved ossicle in all the studies. However in present study incidence of Malleus erosion was most frequently observed. Most studies have stated that erosion of scutum is also a common finding associated with cholesteatoma. Also involvement single or multiple ossicles is associated with the severity of disease process and a poor prognostic indicator. In this study, facial canal dehiscence was noted in 2 patients amounting to 6% of the study population which was similar to that found by Firas Q Alzoubi et al and Garber et al. Incidence of dural plate erosion of mastoid was slightly less than the findings of Ranga Reddy Sirigiri et al. Sigmoid sinus plate erosion was observed in 3% of the cases which is in accordance with studies by Petros V Vlastarakos et al. Mastoiditis and mastoid abscess are the most common complication observed in the study. This is in keeping with the findings of E. Yorgancilar et al. who stated that mastoiditis and mastoid abscess was the most common complication. Intracranial complications were identified in 3% of the study population. The incidence of intracranial complication was less compared to the study by E. Yorgancilar et al. This variation might be because of early diagnosis and intervention in cases of CSOM. In this study, the incidence of cholesteatoma in the protympanum, mesotympanum, posterior tympanum, epitympanum, Hypotympanum was in agreement with studies by Ranga Reddy Sirigiri et al.
In this study there were 30 cases of cholesteatoma. There was considerable variation in the location extent of involvement of cholesteatoma in the study population. Attic was the most common location, similar to that observed by Gaurano JL et al.\(^8\) In this study, non-dependent soft tissue opacity was present in 96.1% of patients with chronic otitis media with cholesteatoma which is similar to findings by Ranga Reddy Sirgiri et al.\(^10\) Ossicles erosion was seen in 60% of patients with chronic otitis media with cholesteatoma. This is similar to findings by Suat Keskin et al.\(^11\) Malleus was the commonest ossicles to be involved. Mastoid cortex erosion was seen in 1 case, Sinus erosion in 1 case and Mastoiditis with sub-periosteal abscess in 1 case were also seen. The radiological findings of temporal bone in patients with chronic otitis media were presence of non-dependent soft tissue mass in most of the cases followed by ossicle erosion, scutum erosion, dural plate erosion, and mastoid cortex erosion. Other findings included mastoiditis with sub-periosteal abscess. In ossicular erosion, malleus was most commonly involved followed by incus and stapes. Most of the mastoid in this study were sclerotic followed by pneumatised and diploic. Chronic otitis media and associated complications can be, at times life threatening as such early diagnosis and treatment is very important. Advent of HRCT and multiplanar assessment ability has definitely improved study of temporal bone in patients with chronic otitis media which includes evaluation of the extent and sites of involvement and inter-relationships of the tympanomastoid compartment with adjacent neurovascular structures. One of the main drawbacks in our study is that soft tissue changes like labyrinthitis could not be evaluated on HRCT. MRI has a higher soft tissue resolution in identification of labyrinthitis. Similarly differentiation between cholesteatoma, granulation issue and effusion is difficult on HRCT. However on MRI this is possible, especially diffusion weighted imaging where cholesteatoma restricts but granulation tissue does not restrict. As such HRCT apart from diagnosis is mainly useful in the preoperative evaluation of the type, location and extent of disease process to help the surgeon in planning further management. Also a further population based study for a longer duration is needed to make a more reliable comparison with the standard studies.

**CONCLUSION**

CSOM is a common disease that can have serious, life threatening complications. As such early diagnosis and treatment is of importance for a good patient prognosis. HRCT of temporal bone is of great value in the diagnosis and preoperative assessment of a case of CSOM. CSOM is more common in the younger age group with a slight male preponderance. Patients usually present with otorrhea. Other symptoms include hearing loss, otalgia, vertigo, tinnitus, fever with chills and rigors, headache, nausea, vomiting, swelling behind the ear and facial weakness. Scutum and ossicular erosion is often present in a case of CSOM with cholesteatoma. Malleus is the most commonly involved ossicle, followed by incus and stapes. Mastoiditis and mastoid abscess is the most common complication, followed by dural plate erosion, mastoid cortex erosion, intracranial complications, facial canal dehiscence. Cholesteatoma was most often noted in the attic followed by holotympanic type extending to the mastoid antrum. The various findings observed in the patients with CSOM are nondependent soft tissue mass, scutum and ossicular erosion, dural plate erosion, mastoid cortex erosion. HRCT of temporal bone is useful in identifying various findings related to the location and extent of disease which are clinically occult and is of great importance in guiding the surgeon in planning the surgical approach.

**REFERENCES**


